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Time to change the paradigm? A mixed method study of the preferred and potential features of an asthma self-management app

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Time to change the paradigm? A mixed method study of the preferred and potential features of an asthma self-management app

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journals.sagepub.com/home/jhi**Chi Yan Hui** 

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Abstract

We explored the potential of asthma apps to support self-management and identified preferred features that enable users to live with asthma. We recruited patients from five UK practices and social media; observed their usage of our app, administered a questionnaire and interviewed a purposive sample of patients and professionals to explore preferred features. Thematic analysis of interview was synthesised with quantitative data. A total of 111 patients used our app for 3 months. We interviewed 15 patients and 16 professionals. Participants were interested in a broad range of self-management support strategies, including action plans, monitoring with feedback, allergy/weather warnings and tailor-made running coaching. Professionals wanted to integrate patients' logs with practice records, though were concerned about data overload and risk of patient dependency. We propose a paradigm shift - from apps developed to provide features that are easy to implement technologically, to an approach in which apps are designed to deliver theoretically grounded preferred components.

Keywords

asthma, mobile application, self-management support, telehealth, valued features

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Introduction

Asthma is a chronic disease affecting over 230 million people worldwide¹ and 4.3 million adults in the United Kingdom.² There is overwhelming evidence that supported self-management of asthma improves control and reduces attacks.^{3–6} British Thoracic Society/Scottish Intercollegiate Guidelines Network (BTS/SIGN)³ describes the core components for self-management as ‘education, action plan and professional support’. However, this is a medical model of self-management. The definition of self-management is broader than this, for example, also including coping with emotional and role challenges of living with asthma.⁷

The Practical Review in Self-Management Support (PRISMS) taxonomy, derived from a systematic meta-review of 969 unique randomised controlled trials (RCTs) of supported self-management in 14 conditions, offers a pick list of support strategies that healthcare systems should consider when developing services to support self-management for long-term conditions.⁸ These include information (about the condition and/or its management), information about available resources, agreement on specific clinical action plans, regular clinical review, monitoring of the condition with feedback, support with adherence, provision of equipment, easy access to advice when needed, training to communicate with healthcare professionals, training for everyday activities, training for practical self-management activities, rehearsal for psychological strategies, social support and lifestyle advice.

Digital technology has the potential to contribute to many of these components.⁹ However, today’s apps typically only focus on logging data.^{10,11} Therefore, we aimed to explore the features that patients and healthcare professionals utilised and wanted in a self-management app with reference to the theoretically grounded broader approach of the PRISMS framework.

Methods

Ethical approval

The study commenced in September 2016 and ended in July 2017, with the approval of the NHS South East Scotland REC 02 and NHS HRA (ref: 16/SS/0101). All participants provided their fully informed consent.

Design

We used mixed methods including user feedback on a prototype app, questionnaire surveys about preferences and qualitative interviews exploring patients and professional perspectives on self-management features. Building on frameworks described by Creswell et al., the qualitative analysis is the major component of the study; we included some observational quantitative data to enrich the description of the ‘wanted’ features.

Practice and patient recruitment

Practice recruitment. We recruited five primary care practices meeting our eligibility criterion (an asthma trained nurse willing to participate in the study) in Lothian (Scotland) and Oxford (England). The Scottish Primary Care Research Network (SPCRN) invited potential practices from diverse demographic areas: rural village, suburban, town and city, representing different populations with respect to deprivation and age. We also approached a practice from Oxford, operating within the English healthcare system.

Patient recruitment for piloting prototype 'app'. We recruited patients through their primary care practices and through social media to use the prototype app and provide quantitative usage and questionnaire data. We aimed to recruit adult asthma patients who could manage their own asthma independently:

- *Recruitment through their practice.* We included patients (aged 16 years old or over) with active asthma,¹² identified from the practice register. Patients were invited by letter from their family doctor. Patients who had annual asthma reviews within our study period were invited to participate by their asthma nurse during the consultation.
- *Recruitment through social media.* We posted advertisements on Facebook and Twitter accounts of Asthma UK and the Asthma UK Centre for Applied Research. Patients who were interested in trying our app were asked to confirm their eligibility by answering the eligibility questions (adults with asthma registered with a UK general practitioner (GP)). Eligible patients were automatically directed to the information leaflet on our project website and read the information before giving consent, registering and using the app.

Sampling for qualitative interviews. We used purposive sampling, from among those invited by their practice for individual interviews, to achieve a maximum variation sample. Sampling was based on age: young adults (16–25 years), adults (26–60 years) and older adults (60+ years); ownership (or not) of an asthma action plan; and previous user (or not) of healthcare apps. We sampled 15 patients, a number likely to achieve data saturation and practical within our resources, for individual interviews. We also requested interviews from the healthcare professionals involved in asthma care.

App prototype

Our prototype app was built on the uMotif¹³ platform and provided self-management support features to patients. We chose the app's features with reference to the comments from our lay and professional advisory groups (four asthma patients invited from the Patient and Public Involvement group in the Asthma UK for Centre for Applied Research, five GPs and two asthma nurses). Some screenshots are shown in Figure 1 and the features are described in Table 1. Participants used the app for up to 3 months. Patients who did not have an asthma action plan were advised to arrange a consultation with their GP/asthma nurses to complete an action plan on the app.

Data collection

We collected data in three ways:

- *Usage data.* We collected the patients' routine app data: weekly usage, usage frequency of each of the features (10-symptom 'motif', asthma action plan, diary, medication list, lung function log, medication reminder, task reminder; we could not monitor the use of the shared health report), retention rate and monitoring data at 30, 60 and 90 days.
- *Questionnaire data.* All patients were invited to complete online questionnaires about features they 'wanted' to support their self-management before and after using the app. The pre-study questionnaire was part of the registration process and the post-study questionnaire automatically appeared on the patient's app on day 90. See Supplementary file A for the questionnaires.

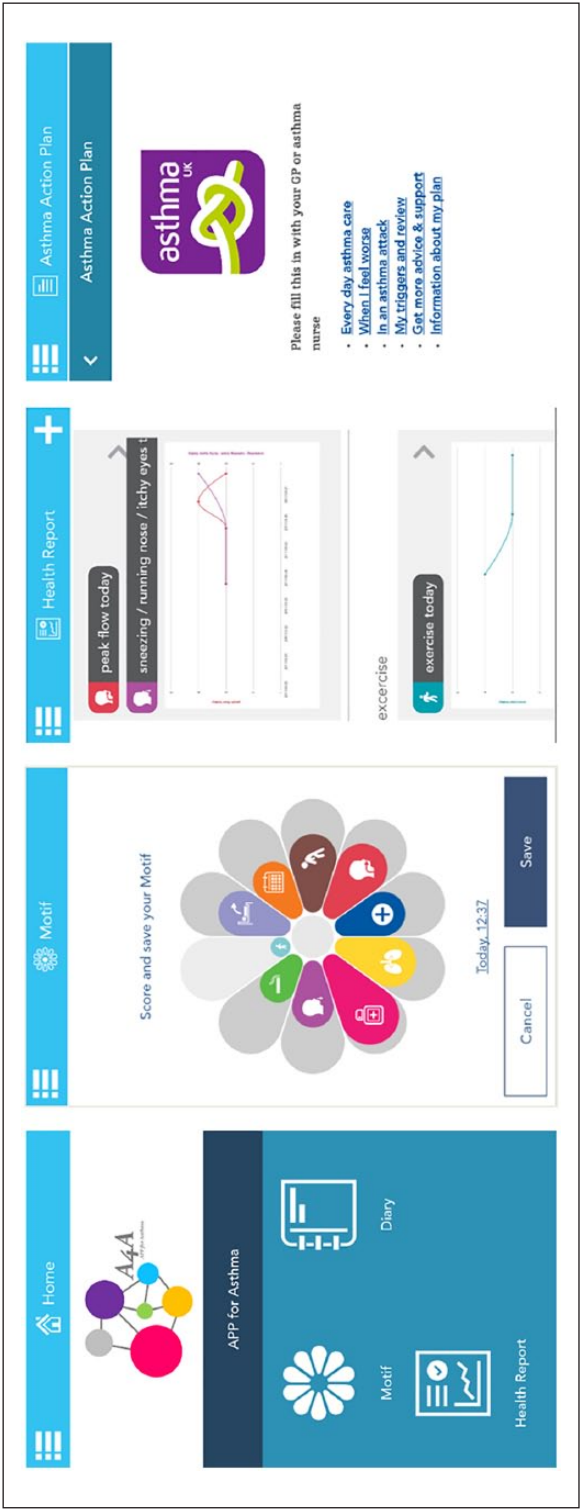


Figure 1. Screen shots of our app: (from left) home, 10 symptom questionnaire, health report and asthma action plan. uMotif configured their app platform for our chosen features.

Table 1. Description of the features of our prototype app.

Features	Description
Home	This allowed quick access to the 10-question motif, health report and diary. A menu button was provided on the left top corner of the app to allow access to different features.
10 question 'motif'	This contained 10 questions for patients to log their asthma conditions (e.g. symptoms and medications).
Health report	This compiled a report of patient's logs over time which could be shared with their healthcare professionals via a weblink.
Asthma action plan	This was the template of the Asthma UK action plan. Patients were advised to fill this in with their practice nurse during a review.
Diary	This allowed patients to use free text and pictures to log their activities.
Medication	This allowed patients to record their medication in detail (e.g. its name, image and the dosage).
Medication reminder	This allowed patients to set an alarm to remind them of their medication.
Lung function	This allowed patients to make logs of their lung functions, such as their best peak flow in numbers.
Task reminder	This allowed patients to set alarms to remind them to do tasks (e.g. do exercise).
Enquiry box	These enquiries were sent to our technology partner and researchers to answer.
Tutorial	This appeared during the registration process and provided patients with an interactive tutorial which gave comprehensive instructions to teach patients how to use the app.
Settings	This allowed patients to enlarge question segments, change the input units, allowed location sharing and provided details of the app's policy.

- *Qualitative interviews.* Patients were interviewed before and after using the app for 30 days, to explore their preferences for supporting features available – or wished for – on the app. Healthcare professionals from participating practices were asked about the potential of the app to support self-management and the interface with their clinical practice. Practice managers and administrative staff were asked for their thoughts on the potential impact on their workload if an app system were implemented. See Supplementary file B for the topic guides.

Data synthesis and analysis

Quantitative analysis. Patients' questionnaire ratings of the app features they wanted, their usage of the features of our app and their pre-/post-study action plan ownership were analysed using descriptive statistics.

Qualitative analysis. Interviews were digitally recorded, transcribed and entered into NVivo version 11¹⁴ for analysis. We used framework analysis employing PRISMS taxonomy of self-management support strategies to explore the features that patients and practices wanted to support their self-management.⁸ Two reviewers (C.Y.H. and H.P.) discussed the interviews, coded one interview independently and compared decisions to standardise the coding. The agreed framework and coding conventions were used to code the rest of the transcriptions, with additional decisions discussed iteratively within the study team.

Interpretation

The results of the data synthesis were discussed with a lay advisory group and with a multidisciplinary team of healthcare professionals, ehealth researchers, technology developers at a number of conferences and meetings.

Results

Participants

Professionals. Five medical practices in the UK were recruited (four in Lothian and one in Oxford). Sixteen GPs, asthma nurses, practice manager/receptionists in the five practices were interviewed (14 in Lothian and 2 in Oxford). Most of the participants did not have experience of using healthcare apps or activity tracking devices.

Patients. A total of 111 patients were recruited to pilot the prototype ‘app’ and provide usage/questionnaire data (22 via their practice; 87 from social media). The pre-study questionnaire was completed by 101 patients, 23 filled in the post-study questionnaire. The majority (87%) were female, in the 26–45 years old age group (58%) and only 43 per cent had an asthma action plan. Fifteen patients with a range of demography, healthcare and technological experience contributed to the qualitative data collection. Their characteristics are detailed in Table 2.

Usage of the features of the prototype app

Patients’ usage of the self-management support features are summarised in Table 3. The 10-question ‘motif’ was used at least once by almost all the patients (98/111, 88%); the next most commonly used features were the asthma action plan (42/111, 38%) and diary (40/111, 36%). Of the 98 patients who used the ‘motif’, 18 only used the feature once. Other patients used it at various time intervals: daily, weekly or monthly. Eleven of the patients did not use any of the eight features on the app; none of whom had any experience of healthcare apps although six were recruited by social media. A logging reminder that ‘popped-up’ at 18:00 every day was a built-in feature in the app. In total, 105 (105/111, 95%) patients kept this feature, 6 patients (6/111, 5%) disabled it.

Action plan completion. During the course of the study, the proportion of action plan ownership increased from 43 per cent (42/98) to 63 per cent (62/98). Of the 20 patients who were without an action plan before our study and adopted one on our app, 9 patients told us how they completed the plan. Five of them completed the action plan without consulting their GP/asthma nurse; three asked their asthma nurse to complete a paper-based action plan and transferred the data onto the app themselves; and one completed the action plan on the app with an asthma nurse during a consultation.

Perceptions of patents and healthcare professionals on features related to the PRISMS taxonomy

Table 3 maps the usage of features on the prototype app, questionnaire responses and findings of the qualitative interviews related to the 14 items of the PRISMS taxonomy. Additional supporting quotations can be found in Supplementary file C. Figure 2 illustrates the features that patients wanted in an app. The text below synthesises the findings from the qualitative interviews with the usage and questionnaire data.

Table 2. Practice and patient demographics.

Practice	Demographics	Number of patients	
		App use	Interviews
Practice A (n = 3)	Scotland: A city practice with 11 GPs with and 5 asthma nurses.	3	1
Practice B (n = 7)	Scotland: A suburban practice with six GPs and two asthma nurses.	7	5
Practice C (n = 4)	Scotland: A town practice with four GPs and one asthma nurse.	4	4
Practice D (n = 3)	Scotland: A rural village practice group combined with two practices. More than four GPs and two asthma nurses.	3	2
Practice E (n = 3)	England: A suburban practice with 11 GPs and 2 asthma nurses.	2	3
Patients	Demographics, clinical features and technological expertise	Number of patients	
		App use	Interviews
Age range (n = 101)	16–25 years	15 (14.9%)	1 (1%)
	26–45 years	59 (58.4%)	7 (6.9%)
	46–65 years	24 (23.8%)	4 (4%)
	65+ years	3 (3%)	3 (3%)
Gender (n = 98)	Female	88 (87%)	10 (10.2%)
Asthma plan ownership (n = 98)	Yes: written plan	42 (42.9%)	10 (10.2%)
	Verbal information	18 (18.4%)	1 (1%)
	No	38 (38.8%)	4 (4.1%)
Medication (n = 98)	Use regular preventer medication	92 (94%)	15 (15.3%)
Experience of healthcare apps (n = 98)	Yes, still using at least one healthcare app	7 (7%)	0 (0%)
	Yes, but not using them	11 (11%)	2 (2.04%)
	Never used a healthcare app	80 (82%)	13 (13.3%)
Platform (n = 98)	Android smartphone/tablet	28 (29%)	7 (7.14%)
	Apple iPhone/Apple iPad	70 (71%)	8 (8.16%)

GP: general practitioner.

The features that respondents to the questionnaires said that they wanted varied. Most of the patients and healthcare professionals wanted to see asthma action plans and the ability to monitor their asthma with feedback features on the app. Although patients used the monitoring and action plan more than other features on our app, <40 per cent actually used the action plan.

Other desired features were related to patients' asthma type. Ninety per cent of patients, who had pollen/environmental-triggered asthma, wanted to be able to cross reference their asthma logs with environmental factors to suggest possible triggers and support decisions on everyday activities. Some people with exercised-induced asthma wanted to incorporate exercise coaching elements on the app such as advice on running intensity with reference to their asthma. In contrast, there was less interest in incorporating weight loss and smoking cessation elements. Although not available on the app, some patients mentioned they would like to share their asthma story on social media, and wanted the facility to order repeat prescriptions. Game elements such as avatars, virtual pet or shooting games to incentivise adherence to peak flow logging and taking medication were not considered desirable by most of the patients.

Table 3. Summary of patients' and healthcare professionals' wanted features on asthma self-management app.

Taxonomy item	Wanted application features	Actual usage of our app (n = 111) (no. of users (used))	Patient questionnaire responses (n = 98)	Qualitative data: patients' thoughts	Qualitative data: healthcare professionals' thoughts
Information about asthma	Providing information about how to manage their asthma (e.g. how to use my inhaler, use of action plan, tips on managing my asthma etc.) ^a	Providing links about asthma management information [NA]	86 (88%) like 9 (9%) neutral 3 (3%) dislike	Majority of patients wanted to have asthma management information on the app [+++]	A GP thought providing information support was 'a good thing'. [+]
Information about available resources	Showing patients the daily pollen count in their area ^a	Providing links about environmental information such as pollen count and temperature [NA]	78 (80%) like 13 (13%) neutral 6 (6%) dislike 1 (1%) [NA]	Majority of patients wanted to have environmental information on the app instead of providing links. [+++]	
Provision of/ agreement on specific clinical action plans and/or rescue medication	Asthma action plan and warn patients if their asthma was getting worse or if they were having an attack Asthma action plan that shows patient's symptom scores and daily peak flow on a 3 colour graph (green, amber and red) ^a Asthma action plan that could tell patients what to do if their asthma was getting worse ^a	Asthma UK action plan (with advice but without prompts) (42 (38%))	91 (93%) like 4 (4%) neutral 3 (3%) dislike 89 (91%) like 7 (7%) neutral 2 (2%) dislike 93 (95%) like 4 (4%) neutral 1 (1%) dislike	Majority of patients wanted to have a more 'Intelligent' action plan such as (a) auto updating after consultation (b) notify patient's GP or asthma nurse when symptoms were getting worse and give advice. [+++]	Majority of healthcare professionals were positive about implementing an action plan. However, there was concern about who will be responsible for picking up the 'worse symptom' notifications. [+++]
Regular clinical review	Routine review reminder Transfer log data to practice database prior to consultation facilitating the option of teleconsultation	NA NA	79 (80%) like 16 (16%) neutral 3 (3%) dislike Not in the questionnaire	Most patients were positive to this feature. [+++] Some patients wanted to transfer their data to the practice health record to determine if a consultation is necessary. [++]	Professionals' perception of the effectiveness of this feature varied (0) Some GPs and asthma nurses suggested this could save patients' time if a routine clinic consultation was not necessary. [++]

Table 3. (Continued)

Taxonomy item	Wanted application features	Actual usage of our app (n = 111) (no. of users used)	Patient questionnaire responses (n = 98)	Qualitative data: patients' thoughts	Qualitative data: healthcare professionals' thoughts
Monitoring of condition with feedback	Log asthma symptoms or peak flow, medication use ^a	(a) 10 symptom 'motif' interface questionnaire logs (symptoms, peak flow, use of medication etc.) and reminded patients about action plan (though did not provide 'alerts') (98 (88%)) (b) Lung function (28 (25%))	91 (93%) like 6 (6%) neutral 1 (1%) dislike	Most patients suggested logging would be only useful if their readings were sent to their practice for feedback. [+++]	Most healthcare professionals were positive about receiving patient's logs. However, there was concern that some patients may become dependent on feedback as opposed self-monitoring. [+++]
	Logging reminder ^a	Asthma UK action plan with advice but without prompts (42(38%))	89 (91%) like 6 (6%) neutral 3 (3%) dislike	Patients, who were already motivated, returned to the app because of the logging reminder. [++]	No practice staff mentioned this feature. [NA]
	Medication reminder ^a	Medication reminder (13 (12%))	73 (74%) like 16 (16%) neutral 10 (10%) dislike	Most patients were positive about this feature. Patients who tended to forget their medication wanted this reminder; others thought taking medication was already part of their daily routine. [+++]	No practice staff mentioned this feature. [NA]
Practical support with adherence	Medication 'low': reminder to order new inhaler	NA	66 (67%) like 20 (20%) neutral 13 (13%) dislike	Most patients were positive about this feature. They felt it would help to 'get over a problem', 'massively help' and 'important'. [+++]	No practice staff mentioned this feature. [NA]
	Smart inhaler	NA	Not in the questionnaire	One patient wanted a smart gadget to count medication usage. [+	No practice staff mentioned this feature. [NA]
	Peak flow metre	NA	Not in the questionnaire	Most patients suggested having a peak flow metre did not encourage them to log their peak flow. [---]	No practice staff mentioned this feature. [NA]

(Continued)

Table 3. (Continued)

Taxonomy item	Wanted application features	Actual usage of our app (n = 111) (no. of users (used))	Patient questionnaire responses (n = 98)	Qualitative data: patients' thoughts	Qualitative data: healthcare professionals' thoughts
Provision of easy access to advice or support when needed	Repeat prescription ordering (either on app or a link to the practice website)	NA	64 (65%) like 26 (27%) neutral 8 (8%) dislike	Most patients were positive about this feature. They suggested it was 'useful' if this could work for other medications as well. It was important to connect the practice's prescription system with the pharmacy to order and collect the medication directly. [+++] One patient wanted the app to pick up if she over-ordered her inhalers. [+]	Some practices, who were already using electronic prescribing, felt it was 'useful' and 'easier'. [++]
	Prescription ordering auto-check to advise patients on overuse	NA	Not in the questionnaire		Most practices already had systems to check for over-ordering, however, not real time checking. An asthma nurse argued that it was 'very, very difficult' not to give a patient medication because this was 'dangerous'. They would pick up over-use during annual review (though not all patients attended reviews), (0)
	Panic button for emergencies (to the duty doctor in the practice, to NHS111 or 999)	NA	58 (59%) like 30 (31%) neutral 10 (10%) dislike	Some patients suggested a panic button needed to be available even on the locked screen. It would be 'quite handy' if the app could pop up their medical record when the button was pressed; it would be 'beneficial if the medical record was in different languages' when they were in different countries. [++]	No practice staff mentioned this feature. [NA]

Table 3. (Continued)

Taxonomy item	Wanted application features	Actual usage of our app (n = 111) (no. of users used)	Patient questionnaire responses (n = 98)	Qualitative data: patients' thoughts	Qualitative data: healthcare professionals' thoughts
Training/rehearsal to communicate with healthcare professionals	Share logs with GP/asthma nurse ^a	Show logs to GP/asthma nurse on app or screen capture, or to share logs with GP/asthma nurse (2 (2%) [†])	86 (8%) like 11 (11%) neutral 1 (1%) dislike	Most patients 'wanted' to share data with their GP/asthma nurse. They felt it was 'useful', 'very useful' and 'really handy'. [+++]	Most professionals felt logged data was 'helpful', 'useful' and 'good', though needed to be presented: 'efficiently' to avoid sending them a 'cloud of data'. Data should be transferred into their practice records, so information on patients was up-to-date. [+++] No practice staff mentioned this feature. [NA]
	Cross refereeing patients' asthma logs with environmental factors to suggest possible triggers for their asthma Alert patients when the pollen count in their area is high	NA	94 (96%) like 4 (4%) neutral 0 (0%) dislike	Most patients wanted this feature. They suggested it was 'fascinating' and 'useful'. [+++]	No practice staff mentioned this feature. [NA]
Training for practical self-management activities	Game elements to encourage self-management tasks such as logging peak flow and taking medication (avatar or virtual pet or simple shooting game etc.)	NA	83 (85%) like 8 (8%) neutral 6 (6%) dislike 1 (1%) [NA]	Those patients whose asthma was triggered by pollen or weather, wanted a pollen count or weather information on the app to help them avoid triggers. [+++] Some patients were interested in intelligent interaction with the app (e.g. an avatar to 'chat' with them about their asthma. Some patients were positive about a point-earning system to encourage data logging). [+++] No patients mentioned this feature. [NA]	No practice staff mentioned this feature. [NA]
	Checking inhaler technique	NA	25 (25%) like 29 (30%) neutral 44 (45%) dislike	Not in the questionnaire	A GP suggested this features could support checking inhaler technique remotely, potentially reducing the need for 'in person' consultations. [++]

(Continued)

Table 3. (Continued)

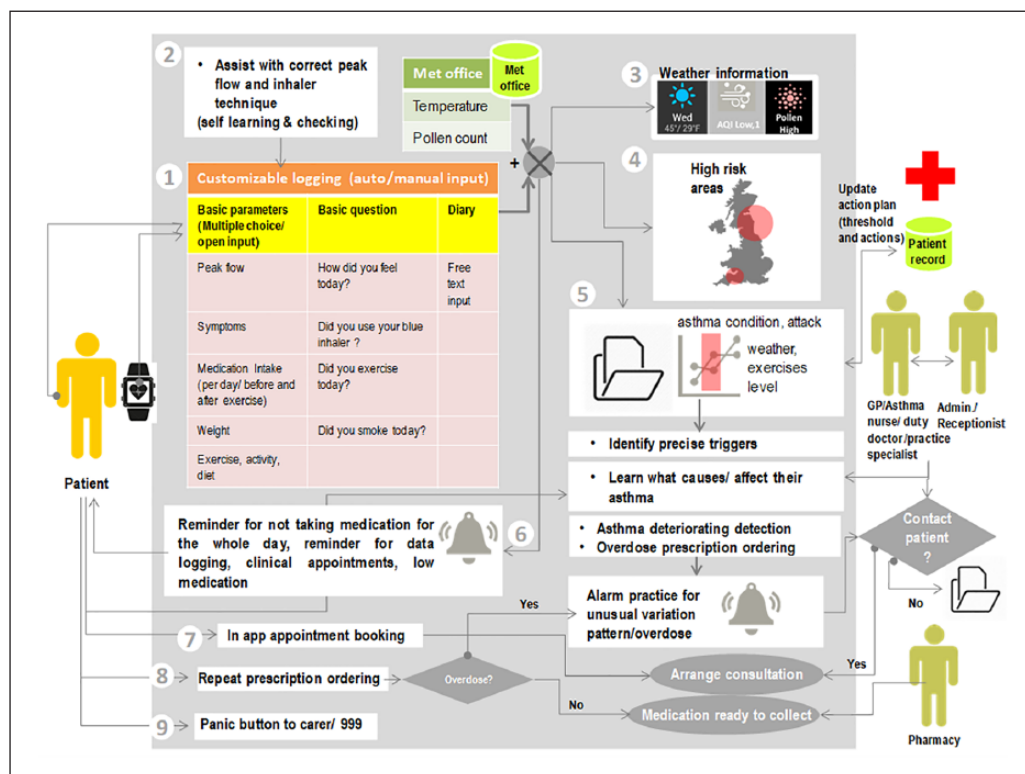
Taxonomy item	Wanted application features	Actual usage of our app (n = 111) (no. of users (used))	Patient questionnaire responses (n = 98)	Qualitative data: patients' thoughts	Qualitative data: healthcare professionals' thoughts
Training/rehearsal for psychological strategies	Providing stress free exercises or playing music to help patient to relax	NA	46 (48%) like 37 (37%) neutral 15 (15%) dislike	Most patients preferred not to have cross-platform links in an asthma app. [---]	No practice staff mentioned this feature. [NA]
	Diary and logging reminder ^a	a) Pop up push notification at 18:00 everyday (105(95%)) enabled the notification; b) Diary reminder (40(36%)) c) Task reminder (2(1.8%))	Not in the questionnaire	One patient suggested that keeping a diary was a way to raise her spirits and a feeling of caring. [+]	No practice staff mentioned this feature. [NA]
	Sharing diary/asthma stories/ status in social media	NA	Not in the questionnaire	Some patients mentioned that asthma was personal; therefore, they wouldn't want to let anyone know about it on social media. Another patient suggested having a social forum on the app to share asthma information with others. [---]	No practice staff mentioned this feature. [NA]
Social support	Interacting with patients via a social media page organised by their practices	NA	Not in the questionnaire	No patients mentioned this feature [NA]	A GP, who had ran a practice Facebook, pointed out that time was the 'massive barrier' to this service. [-]

Table 3. (Continued)

Taxonomy item	Wanted application features	Actual usage of our app (n = 111) (no. of users used)	Patient questionnaire responses (n = 98)	Qualitative data: patients' thoughts	Qualitative data: healthcare professionals' thoughts
Lifestyle advice and support	Exercise coaching elements/ activity tracking	NA	67 (68%) like 21 (21%) neutral 11 (11%) dislike	Some patients who had exercise induced asthma felt it would be 'quite good' 'useful' 'interesting' to be able to track their exercise/activity related to their asthma condition (such as the treatment they took before/after exercising). [++]	No practice staff mentioned this feature. [NA]
	Helping patients to watch their weight as well as their asthma conditions	NA	44 (45%) like 30 (31%) neutral 21 (21%) dislike 3 (3%) [NA]	Some patients who were watching their weight, thought this was 'a really good thing' and that they 'would definitely keep using' the asthma app if it had incorporated weight loss or healthy eating features. [++]	No practice staff mentioned this feature. [NA]
	Smoking cessation feature	NA	4 (4%) like 17 (17%) neutral 14 (14%) dislike 64 (65%) [NA]	Most patients were non- smokers. One patient who smoked didn't feel it needed to be included in an asthma app; if she chose to quit, she could get support from their local pharmacist, or elsewhere. [-]	No practice staff mentioned this feature. [NA]

GP: general practitioner. +++: majority of the participants were positive; ++: some of the participants were positive; +: a few of the participants were positive; 0: participants had varied/neutral opinions; ---: majority of participants were negative; --: some of participants were negative; -: a few of participants were negative; 0: participants who responded to the post questionnaire.

^aIndicates features implemented on the app that participants had been using.



Provision of asthma action plans. Over 90 per cent of patients wanted a digitised action plan but they felt that the plan needed to be ‘intelligent’ such as auto updating their best peak flow and treatment schedules after consultations and to notify them when symptoms were getting worse and to give advice. Sending a notification to the practice computer system when symptoms were moving into the amber zone of the action plan was also suggested by some of the healthcare professionals. However, there was concern about who would pick up the alarm:

So if things weren’t good then Google would tell us and then we could text back or send a message saying this is going on could you come and see us. (Asthma nurse 01)

It depends where the alarm is situated ... It would be annoying if it was on the actual front reception desk where we're very busy, patients coming in, telephone calls coming, whereas if it was in a specific, you know obviously we have the admin team, you know in the rear office therefore it would pull attention and somebody would obviously attend to it. (Administration staff 04)

Thirty-eight per cent of our app users looked at the action plan, though they felt that the app did not encourage them to use it. However, they suggested the app did provide a trigger for some patients who did not already have an action plan, to acquire one.

Monitoring of condition with feedback. Over 90 per cent of patients indicated in the questionnaire that they wanted to be able to log their condition on the app, though in reality 75 per cent (83/111) had stopped logging by 30 days. The commonest reason given for stopping logging was that they had well-controlled asthma and that they 'knew themselves'; therefore, it was boring or unnecessary to monitor their peak flow or symptoms:

Bored to the extent that I think 'why am I doing this?' ... I know how to manage my asthma. (Patient participant A7, 65+, M)

Patients suggested the logs 'needed' to be sent to their healthcare professional in order to make logging worthwhile. Most healthcare professionals were positive about responding to patients' logs and one GP suggested it was helpful because 'they (the practices) don't have a mechanism for knowing when people are either symptomatic or asymptomatic unless they have an exacerbation'. However, some thought this approach might create patient dependence on professionals and discourage self-management. For logging frequency, some suggested it could be adjusted according to asthma controlled status:

Well as long as my asthma is very minor and it's under control but if it got to a stage where my asthma was beginning to be a big problem and was out of control then it might be useful to have the app giving me extra information but I don't need it just now. (Patient participant A1, 46–65, M)

Discussion

Summary of findings

Patients and professionals expressed interest in a broad range of self-management support strategies that they would like to see incorporated into an app. The most 'wanted' features were provision of asthma action plans and monitoring of control with feedback. Professionals wanted to be able to transfer patients' logs to their practice records, though they were concerned about managing data and the potential for encouraging patient dependency. Apps had the potential to support routine tasks, such as ordering medication, and providing reminders. Flexibility was needed to enable those who wanted specific features (such as monitoring of environmental triggers or running coaches) to address individual problems or cope with their asthma in particular contexts.

Strengths and limitations

Our study identified a number of features that patients and professionals wanted in an asthma self-management app; however, there are some limitations. First, we only recruited from five practices, though they were demographically diverse and people recruited via social media

extended the population beyond these practices. We excluded ‘high risk’ asthma patients and children under 16 years, and females and 26–45 years old were over-represented which limits generalisability. In addition, it is highly likely that participants were those with an interest in using technology for their health.

Second, we had limited flexibility to change the modules and design (button, notification, message box and positions) which may have influenced opinions. However, we explored other potential features with patients in the interviews and the online questionnaire.

Third, we selected a sample size of 15 for the qualitative interviews. Our purposive sampling ensured a range of perspectives, and we achieved data saturation with regard to ‘wanted’ features; however, we may not have encompassed all possible perspectives.

Finally, we could not explore some detailed usage data (such as the average time that participants spent on each feature), though the usage data we used gave an overview of patients’ preference for different features and we asked patients about their usage in interviews and questionnaires to supplement the information.

Interpretations in relation to published literature

Healthcare is one of the core capabilities in the coming 5G Smart City 2.0, which promotes a vision of technology moving from providing standalone tracking and monitoring applications to intelligent applications that connect people and are capable of responding to people’s behaviour in order to solve real-world complex challenges.^{15–17} Different stakeholders are enthusiastic to engage in this future market,^{18,19} though they have different perspectives on telehealth.

Clinically, the focus for variable conditions (e.g. asthma) is on action plans, which advise patients to be aware of deterioration in their asthma control, support their decision on adjusting medication or seeking professional help in a timely manner.^{20,21} Technologically, the emphasis is on easily supported features such as monitoring symptoms, peak flow and treatment usage; providing reminders for logging or medication; and lifestyle monitoring and advice such as activity tracking, weight watching and running coaching.^{12,13,22,23} Patients, however, are living with asthma and the PRISMS taxonomy highlights that the support needed is much boarder than either the clinical and technological perspectives: for example, facilitation of communication with the practice, behaviour change support for medication adherence and lifestyle changes, customised allergen and pollution warnings, inhaler technique advice, and access to support from social media forums. The challenge is to meld these perspectives such that technology can support the wide-ranging self-management support needed by people living with asthma. Hitherto, in many telehealth design projects, a technology-led approach is used to design digital support for patients. Technology providers offer solutions based on what can be measured or easily delivered (ideally avoiding medical device legislation),²⁴ but which may or may not solve the problems faced by patients and healthcare service providers.

Conclusion

We need to shift from a paradigm in which apps are built around features that are technologically easy to deliver, to an approach in which theoretically grounded preferred components are identified and apps designed that can deliver to these requirements. An evidence-based taxonomy of potential components of self-management support could stimulate a dialogue between app developers and both users and healthcare services providers, and underpin technological solutions that address the breadth of support that people need to live with asthma.

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Author contributions

C.Y.H., R.W., B.M. and H.P. designed the study. C.Y.H. undertook the data collection and synthesised the data with H.P. R.P. was the statistical advisor. H.P. is the study guarantor. C.Y.H. with H.P. wrote the initial draft of the manuscript. All authors contributed to the writing of the article and reviewed the final manuscript.

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Supplemental material

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